"A Preliminary study of freshwater algae and its classification system from Nawkhala lake, Nagbhid"

PROJECT WORK SUBMITTED

IN PARTIAL FULFILLMENT OF REQUIREMENT FOR AWARD OF DEGREE OF

MASTER OF SCIENCE IN BOTANY

BY

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2023-2024

CERTIFICATE

This is to certify that the work presented in this project report entitled "**A Preliminary study of freshwater algae and its classification system from Nawkhala lake, Nagbhid"** submitted by **Miss. Bhagyashri R. Gedam** has been carried out under my supervision at the Post Graduate Department of Botany of N. H. College, Bramhapuri during academic year 2023-2024 in partial fulfilment of the requirement prescribed for the degree of **"Master of Science in Botany''** of Gondwana University, Gadchiroli. The work is comprehensive, complete and fit for evaluation.

Ms. Nilima U. Rangari
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DECLARATION

I, hereby declare that the work presented in this project entitled "**A Preliminary study of freshwater algae and its classification system from Nawkhala lake Nagbhid"** has been carried.out by **Miss. Bhagyashri R. Gedam** under the guidance of **Ms. Nilima U. Rangari,** Assistant Prof. & Head of Department of Botany, N. H. College, Bramhapuri.

The project work, submitted for the award of the degree of **"Master of Science in Botany**" of **Gondwana University, Gadchiroli** is original and has not been submitted earlier as a whole or in part to any other university or institution for the award of any degree/diploma or certificate.

Date: / / 2024
Place: Bramhapuri.

Miss. Bhagyashri R. Gedam
M.Sc. (Botany)

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Miss. Bhagyashri R. Gedam
M.Sc. (Botany)

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INTRODUCTION

Defination:

Algae, a diverse group of aquatic organisms, possess the remarkable ability to conduct photosynthesis, making them crucial to various ecosystems. While seaweeds like phytoplankton are familiar examples, the world of algae extends far beyond, playing critical roles in sustaining life on Earth.

Defined as organisms within the domain Eucarya, algae are distinguished from animals by their photosynthetic capability. However, they lack true roots, stems, and leaves, setting them apart from vascular plants. Algae thrive in freshwater environments such as lakes and rivers, often visible only under a light microscope. Despite their inconspicuous nature, they hold immense ecological significance and influence human utilization of natural resources.

Algae exhibit wide temporal and spatial distribution, with many species available year-round and capable of swiftly responding to environmental changes, including pollution. They are abundant and relatively easy to detect and sample, making them valuable indicators of environmental health. Certain algae species are particularly associated with specific types of pollution, aiding in pollution detection and monitoring efforts. Additionally, the presence of certain algae species can indicate clean water, as they tend to thrive in unpolluted environments.

The term "algae" encompasses both prokaryotic organisms like cyanobacteria (commonly known as blue-green algae) and eukaryotic organisms. While algae do not form a natural group descending from a common ancestor, including cyanobacteria in the informal group "algae" is a common practice.

Algae predominantly inhabit aquatic environments, thriving in freshwater lakes and saltwater oceans alike. They exhibit adaptability to a range of environmental conditions, including temperature, oxygen and carbon dioxide concentrations, acidity, and turbidity, underscoring their resilience and importance in diverse ecosystems.

Green Algae:Green algae, representing one of the most diverse and abundant algal lineages in river systems globally, have evolved into two major lineages: Chlorophyta and Streptophyta. Both macroscopic and microscopic forms of green algae are common in streams, inhabiting various substrates such as hard surfaces, aquatic plants, and other algae. Some green algae species are free-floating.

Blue-Green Algae (Cyanobacteria):Cyanobacteria, oxygenic prokaryotes found in almost all aquatic ecosystems, play significant ecological roles despite confusion surrounding their systematic and taxonomic status. They are categorized into four major groupings based on morphological

Characteristics: Chrococcales, Oscillatoriales, Nostocales, and Stigonematales. Each group exhibits distinct ecological roles and niches. Dichotomous keys and images are provided to aid in generic identification.

Classification of Algae:

Algae are classified into three main groups:

1. Chlorophyceae (Green Algae): Characterized by the presence of chlorophyll a and b. Examples include *Chlamydomonas*, *Spirogyra*, and *Chara*.
2. Phaeophyceae (Brown Algae): Containing chlorophyll a, c, carotenoids, and xanthophyll pigments. Examples include *Dictyota* and *Laminaria*.
3. Rhodophyceae (Red Algae): Identified by the pigment r-phycoerythrin. Examples include *Porphyra*, *Gracillaria*, and *Gelidium*.

REVIEW OF LITRATURE

The history of algae spans civilizations, with evidence of macroalgae and seaweed consumption dating back to 2500 years ago in China (Tseng, 1981). Microalgae were utilized by Chinese populations as far back as 2000 years ago during famines, with *Nostoc* serving as a survival food source (Spola et al., 2006). Japanese cultures also recognized microalgae as a food source during the 4th century (Mehu, 2003), while Europeans began incorporating seaweeds into their diets 500 years ago (MeC, 1987). By the mid-17th century, Japanese cultivation of seaweeds for dietary supplements had commenced (Pulz and Gross, 2004). Various species such as *Nostoc*, *Spirulina*, and *Aphanizomonon* have been exploited for centuries in Asia, Africa, and Mexico as nutrient-dense foods (Jensen et al., 2001; Olaizola, 2003).

In the 1940s, microalgae gained popularity as live feeds in aquaculture, and after the 1950s, algal biotechnology rapidly developed, initially in Germany and subsequently extending to the USA, Israel, Japan, and Italy, for protein and fat production from biomass (Burlew, 1953). Concurrently, microalgae's utilization in wastewater treatment and the systematic exploration of algae for biologically active antibiotics began in the 1960s (Borowitzka, 1995).

Algae, simple photosynthetic aquatic organisms, belong to Eukaryota and Prokaryota (Gupta, 1981). They range from single-celled organisms to multicellular forms, with complex macroalgae, including seaweeds, exhibiting well-differentiated structures such as leaves, roots, and flowers (Dawson, 1966; Fritsch, 1977).

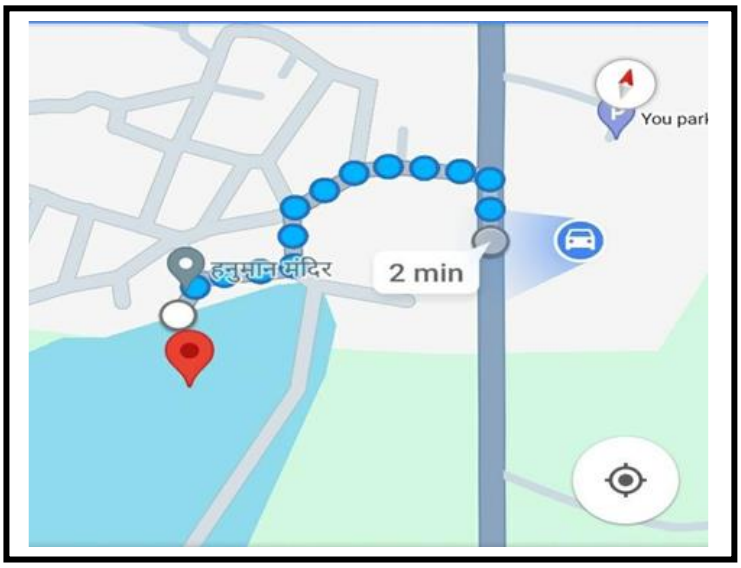
Phytoplankton, the primary biomass producers in aquatic ecosystems globally, inhabit the upper layers of oceans and freshwater habitats where they receive ample solar radiation for photosynthesis (Hader et al., 1998). Algae contribute approximately 2,000,000,000 tons of organic carbon annually, nearly half of Earth's total organic carbon production (Field et al., 1998). Their significant role in utilizing atmospheric carbon dioxide and solar energy underscores their importance as biomass producers, prompting widespread exploration for various applications in pharmaceuticals, nutraceuticals, food production, textiles, aquaculture, biofuels, carbon dioxide mitigation, and bioremediation of heavy metals.

The commercial production of Chlorella as a novel health supplement saw significant success in Japan and Taiwan (Kawaguchi, 1980). In the USA, interest grew in developing algae for photosynthetic gas exchange systems for long-term space travel (Borowitzka, 1999). The energy crises of the 1970s further fueled the idea of using microalgal biomass as renewable fuels and fertilizers through eco-friendly processes (Pulz and Scheibenbogen, 1998; Spola et

al., 2006). Around the same time, the first large-scale Spirulina production plant was established in Mexico (Borowitzka, 1999).

Subsequently, during the 1980s and onwards, more than 46 large-scale algae production facilities were established in the USA and Israel, focusing on microalgae production for protein, fat, and other nutraceutical and pharmaceutical molecules (Spola et al., 2006). These developments underscored the growing recognition of algae's potential in various industries and their importance in addressing emerging challenges related to health, nutrition, energy, and sustainability.

Collection Of algal Sample from from Nawkhala lake Nagbhid



AIM AND OBJECTIVE

- The aim and objective of project is the " A Preliminary study of freshwater algae and its classification system from Nawkhala lake, Nagbhid ".
- Collect the sample From Nawkhala lake, Nagbhid, Dist- Chandrapur
- Identification of different type of algae.

MATERIAL AND METHOD

Materials:

Slides, coverslip glycerine microscope,needle,forcep,dropper etc.

Methods:

The experiment was conducted in the year 2023-2024. For this study we have taken a water sample from Nawkhala Lake Nagbhid. Nagbhid city Dist-Chandrapur. The analysis of samples were carried out at dept. of Botany, N. H. College Bramhapuri Samples was collected in bottles and small vials, the microscopic algae with the help of a planktonic net. The sample were immediately brought to the laboratory for the taxonomical documentation of algal taxa and preserved in 4% formalin for reference purpose. The photography wad made with the help of Trinocular microscopy attached computer with Tucsen camera software and identified by comparing with that of available literature

OBSERVATION AND RESULT

Observation: All my Project work in Nawkhala lake (Nagbhid) collect different algal samples and then identify it.

Table: Found different types of algae with class order, family and genus.

Sr. No.	Class	Order	Family	Genus
1.	Chlorophyceae	Chlamydomonadales	Hydrodictyaceae	*Pediastrum*
2.	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	*Lyngbya*
3.	Euglenoidea	Euglenales	Euglenaceae	*Euglena*
4.	Bacillariophyceae	Naviculales	Staurpneidaceae	*Craticula*
5.	Euglenoidea	Euglenales	Phacaceae	*Phacus*
6.	Bacillariophyceae	Bacillariales	Bacillariaceae	*Nitzschia*
7.	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*
8.	Cyanophyceae	Synechococcales	Synechococcaceae	*Synechococcus*
9.	Zygnematophyceae	Desmidiales	Closteriaceae	*Closterium*
10.	Bacillariophyceae	Pennales	Naviculaceae	*Caloneis*
11.	Euglenoidea	Euglenales	Euglenaceae	*Trachelomonas*
13.	Bacillariophyceae	Thalassiosirales	Thalassiosiraceae	*Thalassiosira*

DISCRIPTON OF ALGAE

1. *Pediastrum*

Systematic Position

Division: Chlorophyta

Class: Chlorophyceae

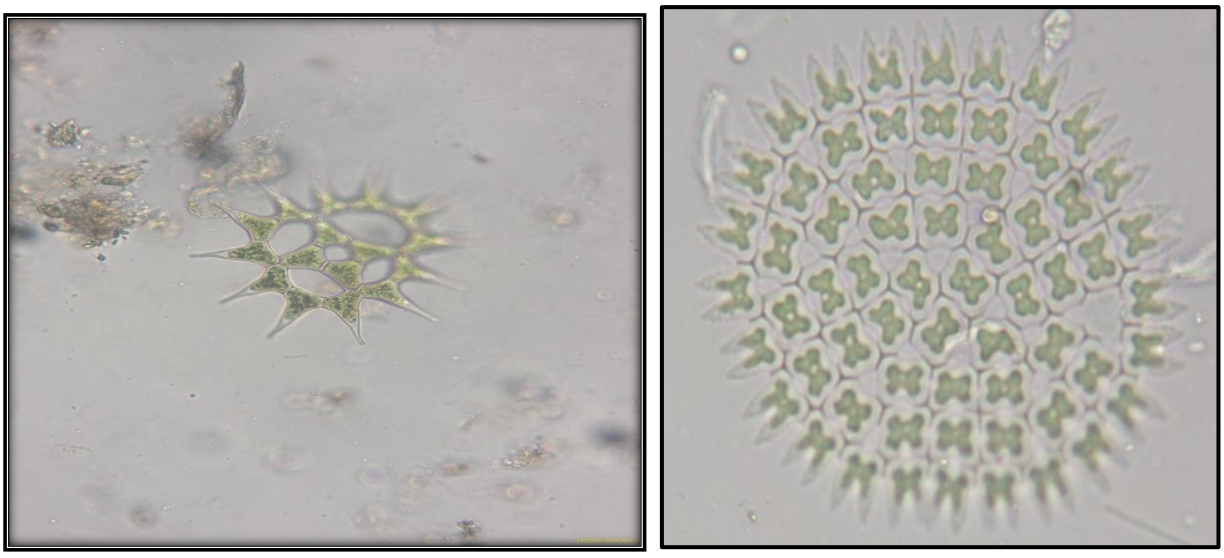
Order: Chlamydomonadales

Family: Hydrodictyaceae

Genus: *Pediastrum*

Identification Character

1. Each species has a unique cell shape and a particular number of cellsin a colony, but all species form the same general pattern.
2. *Pediastrum* is a gene of green algae.
3. It is a photo autotrophic, non- motile coenobium green algae that inhabitsfreshwater environments.
4. The number of cell per colony varies (2-128) depending on the species.
5. Young cell are uninucleate, whereas mature cell may have up to eightnuclei.
6. olonies are disk-shaped & are characterized by peripheralhorn like projections.



Pediastrum

2. Lyngbya

Systematic Position

Division- Cyanophyta

Class: Cyanophyceae

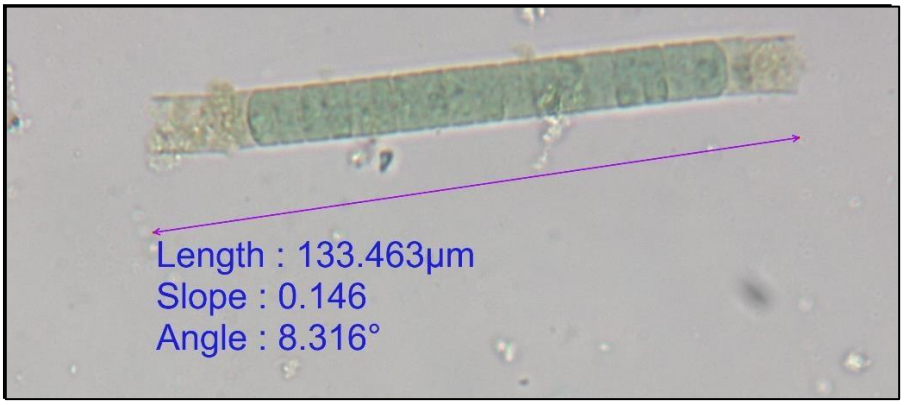
Order: Oscillatoriales

Family: Oscillatoriaceae

Genus: *Lyngbya*

Identification Character

1. Unbranched, untapered, blue-green filaments that are shorter than wide.
2. The filaments are usually straight, slightly wavy, or rarely coiled. They are enclosed in a firm sheath, and may glide within them.
3. The cells are discoid and distinctively shorter than wide.
4. The filaments usually form large, layered, leathery mats of varied thickness.



Lyngbya

3. ***Euglena***

Systematic Position

Class: Euglenoidea

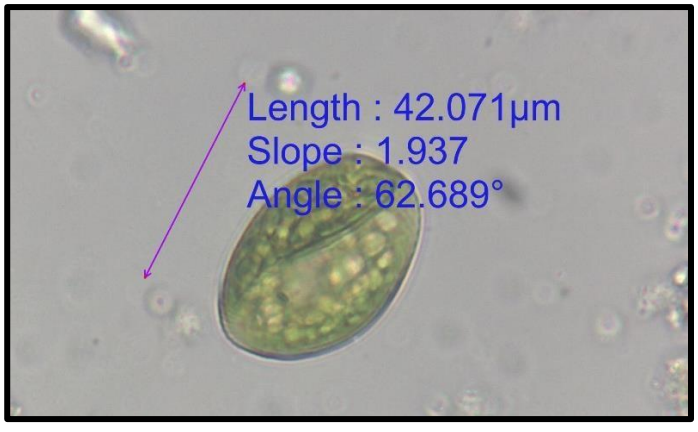
Order: Euglenales,

Family: Euglenaceae,

Genus: *Euglena*

Identification characters

1. *Euglena* are unicellular microorganisms with flexible bodies that have features ofboth plants and animals.
2. They have plastids and perform photosynthesis in light, but move around at night using their flagellum to search for food.
3. *Euglena* are characterized by ann elongated cell (15–500 micrometres)
4. One nucleus numerous chloroplasts (cell organelles that contain chlorophyll and are thesite of photosynthesis)
5. A contractile vacuole (organelle that regulates the cytoplasm)



Euglena

4. Craticula

Systematic Position

Division: Bacillariophyta

Class: Bacillariophyceae

Order: Naviculales

Family: Staurpneidaceae

Genus: *Craticula*

Identification characters

1. Valves are usually laceolate, sometimes tending towards elliptical.
2. The cells have more or less capitate ends and the valve marginmay undulate.
3. The striae are usually strictly parallel consisting valves of rows ofsmall round puncta.
4. The cells contain two plate- like chloroplasts one lying againsteach side of the girdle.
5. Cells are 9.5 - 170 µm long and 3 – 35 µm wide.

Craticula

6. Phacus

Systematic Position

Division-Eukaryota

Class: Euglenoidea

Order: Euglenales

Family: Phacaceae

Genus: *Phacus*

Identification Character

1. *Phacus* is a genus of unicellular excavates, characterized by its flat, leaf shaped structure, and rigid cytoskeleton know as a pellicle.
2. *Phacus* are commonly found in fresh water habitats around the globe andinclude several hundred species that day
3. The chloroplast are present.
4. These eukaryotes are mostly green in colour, and have a single flagellum that extends the length of their body.

Phacus

7. Nitzschia

Systematic Position

Division: Ochrophytina

Class: Bacillariophyceae

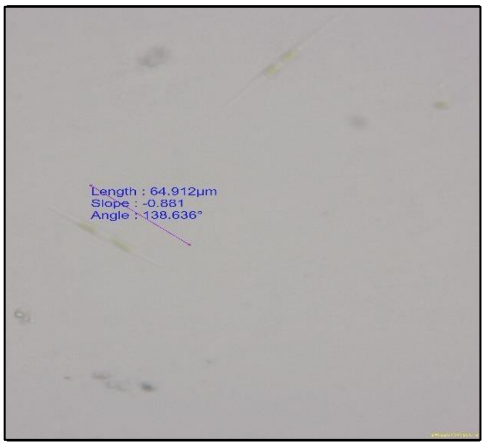
Order: Bacillariales

Family: Bacillariaceae

Genus: *Nitzschia*

Identification Characters

1. *Nitzschia* cells are usually long, straight, and narrow, but can also be ovoid or slightly sygmoid.
2. *Nitzschia* is a large genus of diatoms that includes hundreds of freshwater and marine species.
3. *Nitzschia* species are often found in colder waters, including the Arctic and Antarctic polar sea ice. Some species are also extremophiles that can tolerate high salinity.



Nitzschia

8. Oscillatoria

Systematic Position

Division: Cyanobacteria

Class Cyanophyceae

Order: Oscillatoriales

Family: Oscillatoriaceae

Genus: *Oscillatoria*

-

Identification Character:

1. *Oscillatoria* is a genus of blue-green algae that is commonly found in freshwater environments.
2. It is a filamentous cyanobacterium that forms a thin, bluish-green layer on the surface of objects
3. *Oscillatoria* uses photosynthesis to survive and reproduce.
4. Each filament of O*scillatoria* consists of trichome**.**

Oscillatoria

9. Synechococcus

Systematic Position

Division- Cyanobacteria

Class: Cyanophyceae

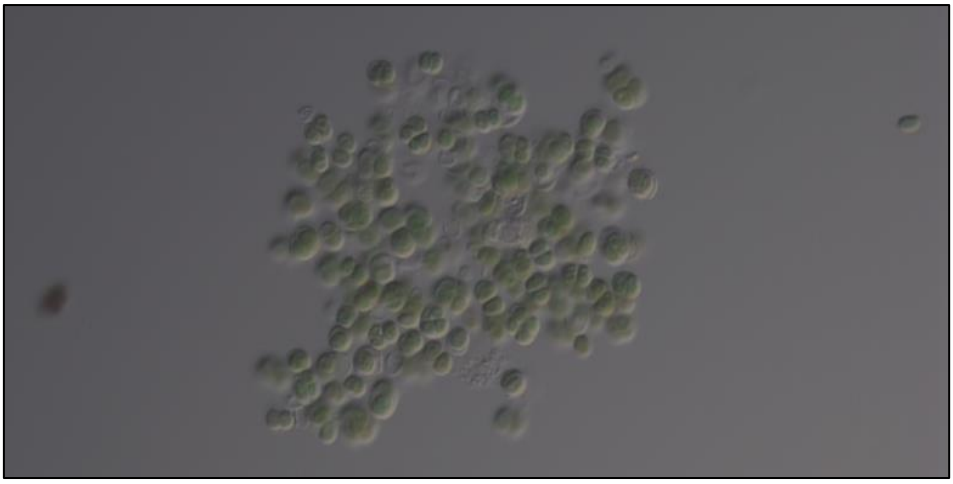
Order: Synechococcales

Family: Synechococcaceae

Genus: *Synechococcus*

Identification Characters

1. *Synechococcus* cells are cylindrical to rod-shaped, and can be up to several times longer than they are wide.
2. They can also be spherical or ellipsoidal.
3. Cells are small, ranging from 0.4–6 μm in size.
4. Cells can be pale blue-green, olive-green, or reddish.
5. *Synechococcus* cells contain phycoerythrin, a pigment that fluoresces orange at an excitation wavelength of 540 nm.



Synechococcus

10. Closterium

Systematic Position

Division:Charophyta

Class: Zygnematophyceae

Order: Desmidiales

Family: Closteriaceae

Genus: *Closterium*

Identification Characters

1. *Closterium* is a common component of freshwater worldwide and can be found in lakes, ponds, and slow-moving streams.
2. It can also be abundant in sewage ponds, though less so in the winter
3. *Closterium* is a key ancestor of land plants and is the best-characterized Charophycean alga.
4. Its life cycle involves both sexual and vegetative reproduction.

Closterium

11. Caloneis

Systematic Position

Division-Bacillariophyta

Class: Bacillariophyceae

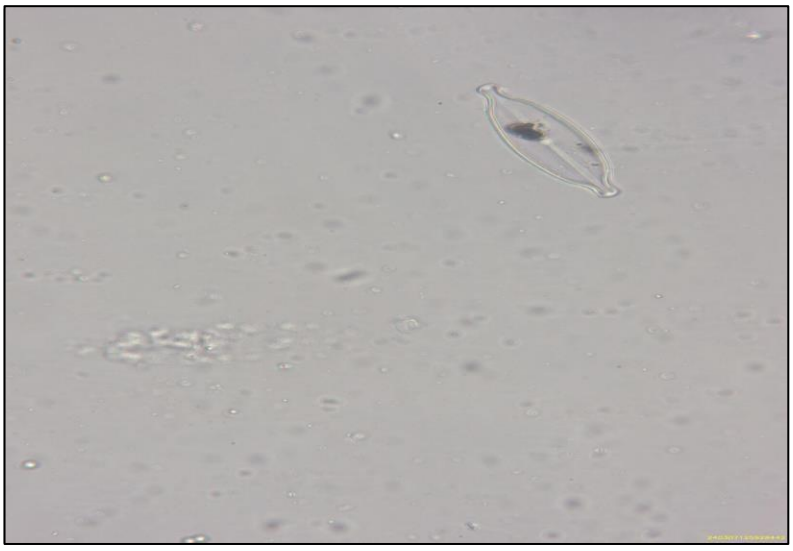
Order: Pennales

Family: Naviculaceae

Genus: *Caloneis*

Identification Character

1. Valves are elliptical to elliptical lanceolate, with capitate apices.
2. The axial area is broad and expanded to form a large lanceolate rhombic central area.
3. The central area is slightly asymmetric from one side of the axial area to the other.
4. The raphe is straight and centrally located.



Caloneis

12. Trachelomonas

Systematic Position

Division-Euglenoidea

Class: Euglenophyceae

Order: Euglenales

Family: Euglenaceae

Genus: *Trachelomonas*

Identification Character

1. The genus Trachelomonas is repre- sented by unicellular, free swimming cells, enclosed in a lorica, usually spherical, oval, or spindle shaped.
2. The cell surface may be smooth, rough, pitted, and possess small or large size punctae.

Trachelomonas

Systematic Position

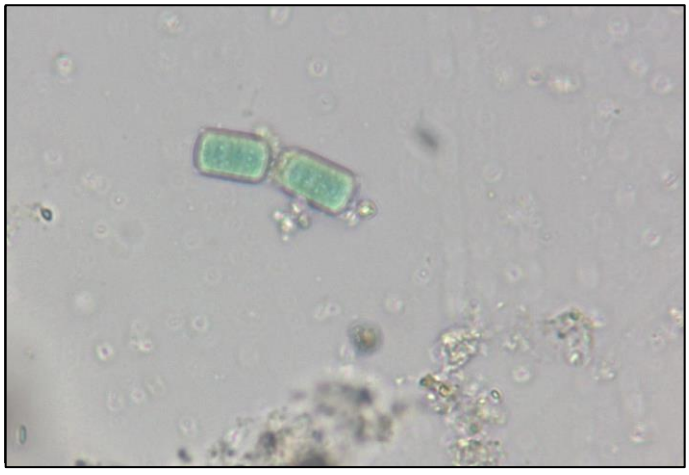
Class: Bacillariophyceae

Order: Thalassiosirales

Family: Thalassiosiraceae

Genus: *Thalassiosira*

3. *Thalassiosira* is a centric diatom
4. Size: 4–32 microns in diameter, larger in winter and smaller in summer
5. Shape: Cylindrical, box-shaped, drum-shaped, discoid, or coin-shaped
6. Cell wall: Silica-based frustule with two valves, a larger epivalve and a smaller hypovalve
7. Valves: Irregular rings with one labiate and two or more central processes



Thalassiosira

DISCUSSTION AND CONLUSION

1. The Nawkhala Lake in the Nagbhid tal. Is identify for the collection of the algae sample. It's the recorded that there are 15 different types of algae belongingto different families.
2. The 12 genera were belonging in, Bacillariophyceae (4), Cyanophyceae (3), Euglenoidea (3). Chlorophyceae (1) Zygnemtophyceae(1), The most identified genus is from the Bacillariophyceae class with 4 genera.

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